REMARKS

Applicants thank the Examiner for the thorough consideration given the present application. Claims 4-36 are currently being prosecuted. Claims 22-25 have been withdrawn from consideration. The Examiner is respectfully requested to reconsider his rejections in view of the amendments and remarks as set forth below.

INTERVIEW

Applicants further thank the Examiner for the telephone interview conducted on March 24, 2004. At this interview, the arguments presented in the present Amendment were presented to the Examiner and his supervisor, Examiner Norton. No agreement was reached as to the allowability of the claims.

Information Disclosure Statement

Applicants submitted an Information Disclosure Statement on June 5, 2003. The Examiner is respectfully requested to acknowledge the Information Disclosure Statement and to provide an initialed copy of the PTO-1449 at the earliest convenience of the Examiner.

Rejection under 35 U.S.C. § 103(a)

Claims 4-21 and 26-28 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nishizawa et al. (USP 5,693,139) in view of Edmond et al. (USP 5,739,554). This rejection is respectfully traversed.

The Examiner points out that the Nishizawa et al. reference shows a method of growing semiconductor monolayers using Gallium and Arsenic along with impurity gases such as magnesium, zinc, cadmium or silicon. The Examiner admits that Nishizawa et al. does not disclose that the times for supplying the impurity raw materials are close to each other.

The Examiner cites Edmond et al. to show the concept of co-doping. The Examiner states that it would have been obvious to one of ordinary skill in the art to modify the method in Nishizawa et al. to form a co-doped GaN layer. However, the Examiner admits that the combination of these two references are silent as to the formation of impurity pairs. The Examiner also admits that the combination is silent as to causing a decrease in activation energy and an increase in carrier concentration.

The Examiner mentions two additional references: Pankove (USP 4,028,720) and Anayama et al. (USP 5,799,027) to show that impurity pairs can be formed by co-deposition. However, the Examiner has not apparently included these references in the rejection. Applicants submit that since the

references are not being applied, that they cannot aid the other two references in forming the rejection.

Applicants submit that the combination of references does not teach the present invention and that the present invention is not obvious thereover. Applicants point out that in the original specification, it was admitted that the prior art shows attempts at co-doping but that the p-type and n-type impurities tended to cancel each other out (compensation effect) so that the carrier concentration becomes the difference between the concentrations of the p- and n-type materials. (Page 2, lines 4-13.) Applicants submit that the Edmond et al. reference is no more than the prior art described on page 2 of the specification. The Examiner is specifically referred to column 4, line 63 of Edmond et al., which indicates that one of the dopants has an amount sufficient to give the GaN layer "a net conductivity type." Thus, the use of the word "net" indicates that this is similar to the prior art mentioned and that it is only the difference between the two types of impurities that is important. Thus, this reference does not teach the concepts of the present application where impurity pairs form a donor-acceptor complex. This is the main thrust of the present invention. These types of complexes which are formed cannot occur in Edmond et al. The Examiner's rejection is based on the premise that the Edmond et al. co-doping is the same as that of the present claims. However, it is clear that this is not the case.

The present invention is able to perform these complexes by carefully controlling the supply of the materials over time so that the impurities are disposed on the layer close to each other as indicated on page 7, line 1 and page 22, line 8 of the present specification. Also, the layer is doped with the impurities at a proper ratio without incorporating disorder into the crystal layer (page 24, line 21). These effects all occur due to the careful control of the timing of the supply of the raw materials.

The Examiner has not given weight to the language, which clearly separates the present claims from the cited references. Thus, the fact that the timing for the raw materials are close to each other, the formation of the pairs as a donor-acceptor complex, the decrease in activation energy, and the increase in carrier concentration have all been brushed over as being obvious to one skilled in the art. Applicants cannot agree. The formation of the impurities pair in this fashion is only accomplished by carefully controlling the timing. The result of these pairs does not occur in the prior art. The Examiner relies on Applicants' own statement that the activation energy and carrier concentration are increased as a result of forming impurity pairs. This is true, however, neither Nishizawa et al. nor Edmond et al. show this formation. At best, Edmond et al. shows an attempt at co-doping, but does not show such a formation that occurs, as presently claimed in terms of the time in which the materials are supplied and also does not show the result of their formation.

Applicants submit that the Examiner has not properly shown how these impurity pairs can be formed since the Edmond et al. reference does not show the formation as presently described.

Furthermore, Applicants submit that there is no motivation shown for the formation of such impurity pairs since Edmond et al. does not show the control and the timing of the raw materials, as admitted by the Examiner. Without this control, Edmond et al. cannot teach the formation of the donor-acceptor complexes and the results which occur therefrom. Accordingly, Applicants submit that the present invention is not obvious over this combination of references.

The Examiner also rejected claim 21 as being obvious over Nishizawa et al. in view of Edmond, as above, and further in view of Manabe et al. (USP 6,472,690). The Examiner states that this reference shows the use of TESi. However, even of this references does teach this, it does not aid the other references in overcoming their deficiencies as noted above.

Applicants have added new claims 29-32, which further describe the close relationship between the impurity materials and the orderly incorporation of the impurities. It is submitted that these claims further define over the prior art.

Applicants have also added new claims 33-36, which further describe that the impurity materials are supplied in a pulsed manner. This describes in more detail the manner in which the impurity raw materials are supplied.

Claims 4-20 also depend from independent claims 21 and 26-28. These claims are likewise considered to be additionally allowable since they cite other features of the claimed invention.

Conclusion

In view of the above Remarks, it is believed that the claims clearly distinguish over the patents relied on by the Examiner, either alone or in combination. In view of this, reconsideration of the rejections and allowance of all the claims are respectfully requested.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert F. Gnuse (Reg. No. 27,295) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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